Wood Identification by Density Determination

PRE-LAB DISCUSSION

In this experiment you will measure volumes of different wood species, using direct and indirect methods. You will also use the relationship between the mass and volume of a substance to find its density.

Volumes of regularly shaped geometric solids can be calculated from direct measurements of their dimensions. For example, the volume of a rectangular solid is calculated by multiplying its length, width, and height *(V = l x w x h).* Volumes of solids are usually expressed in cubic centimeters (cm^3).

Many solids do not lend themselves to direct measurement of their dimensions. These include irregularly shaped objects, such as rocks, and regular solids that are too small to be measured with any degree of accuracy. Volumes of such solids can be measured by water displacement. If a solid is immersed in a liquid, such as water, the solid will push aside, or displace, a volume of water equal to its own volume. Thus, each milliliter of water that is displaced by a solid represents one cubic centimeter of solid volume.

Density is an important property of matter. By itself, or in conjunction with other properties, density can be used to identify substances. Density is defined as the quantity of matter in a given unit of volume. This relationship mathematically is:

$$density = \frac{mass}{volume} \quad \text{or} \quad D = \frac{m}{V}$$

Wood density is weight per cubic foot. Due to wood contracting and expanding when it absorbs and loses water, density is a constantly changing measurement. The importance of this measurement is the relative basis among the different wood species. Density is a way of determining the ease of working a specific species of wood. Dense woods are harder to work with and fasten together, but once fastened they hold much better than less dense types of wood.

You will be expected to use the measuring skills and techniques developed in earlier laboratory experiences and in the first part of this experiment to find the mass and volume of different substances. You will use these data to calculate the density of these substances.

PURPOSE: Learn and practice techniques and calculations for determining density of a substance and identifying the substance

SAFETY: Standard DASD Laboratory safety guidelines are to be followed.

Specific hazards: none

EQUPIMENT: Electronic centigram balance, centimeter ruler, safety glasses

MATERIALS: Wood samples

PROCEDURE

Part I

1. Measure and record the dimensions (length, width, height) of the sample of wood to (± 0.05 cm) Record these measurements in Data Table 1
2. Measure and record the mass of the sample of wood. (± 0.01 g) Record the masses in Data Table 2

Data Table 1

	Sample Id#	Length	Width	Height	Volume (cm^3)
(1)					
(2)					
(3)					
(4)					
(5)					
(6)					
(7)					
(8)					
(9)					

Data Table 2

	Sample Id#	Mass (g)	Volume (cm^3)	Density (g/cm^3)	Type
(1)					
(2)					
(3)					
(4)					
(5)					
(6)					
(7)					
(8)					
(9)					

CONCLUSIONS AND QUESTIONS

1. Calculate the average wood density values of your group

DATA TABLE 3:

Sample	Density (g/cm^3)

2. Calculate the average density (M) from the results in DATA TABLE 4

a. The average density (M) is _____g/cm^3

Sample	**Density***
Cedar	0.21
oak	0.60-0.90
Pine	0.37
Poplar	0.35 -0.50

** All density statistics above were taken from a collaboration of resources and averaged. There are all approximate and should only be used for relative comparisons among each other.*

3. Compute the *absolute* deviation (D_a) for each of the values in DATA TABLE 4.

b. Absolute deviation: D_a= O – M; **observed value – average value**

c. Record this information in DATA TABLE 4

DATA TABLE 4:

Calculated Values	Absolute Deviation (g/cm^3)
1	
2	
3	
4	
5	
6	
Average M: =	
Average Deviation(D_a) =	Uncertainty = ±
The expression for this set of experimental results is: ± g/cm^3	

Questions:

1. What value of a measurement must be available if the accuracy of a measurement is to be determined?_____

2. What are the possible sources of errors in this experiment?_____

3. What is a particular problem finding the density of a wood sample?_____

4. What wood species did you have?_____

5. What is the percent error in this lab?_____

$$\%\text{error} = \frac{\left|\text{observed value - accepted value}\right|}{\text{accepted value}} \times 100\%$$